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Reptiles and Amphibians in the Classroom Zoo*

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Many important phases of biology require such uninterrupted laboratory investigation that it is often impossible for a person dedicated to the study of life to see much of it, or to observe its manifestations in more than a few species of laboratory animals. It is vitally important, therefore, that the investigators of the future should become as familiar as possible with living animals during the course of their training. The best way, of course, to become well acquainted with animals is to visit them at home, but this means field trips, and in these days of overcrowded schools, overworked teachers, and large classes, the amount of field work that can be included in the beginning curriculum is sadly limited.

A classroom zoo must never be thought of as an adequate substitute for field study, but even a few living animals can do much to enliven the teaching of zoology and can provide opportunity for direct observation of many aspects of animal behavior. Most biology teachers recognize the advantages of keeping classroom pets, but many avoid doing so because of the extra labor that their care entails. I propose, therefore, to recommend for the school menagerie some of the toughest, easiest-to-keep reptiles and amphibians, and to suggest certain timesaving procedures.

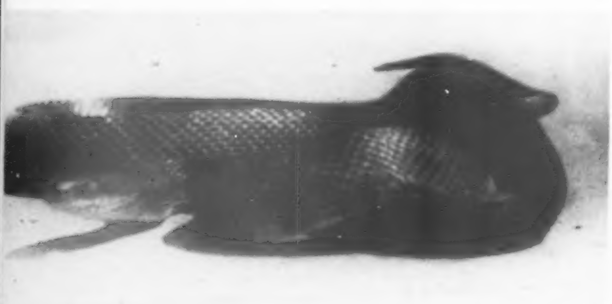
Busy teachers should concentrate upon local animals. It may appear easier to order a distant creature from a dealer than to collect a local species, but it's not the obtaining that matters; it's the upkeep! Exotic specimens often arrive in weakened condition and they usually have food preferences, temperature optima, and humidity requirements difficult to satisfy. Local animals may have less appeal but they have the same life processes and serve equally well to illustrate biological principles.

Small groups of students should be charged with the care of specific animals, and should be encouraged to re-

* Reprinted from *The Science Counselor* for September, 1947.

cord and to report their observations. Many details of the life histories of common species are entirely unknown and questioning youngsters can discover many facts worthy of publication. Uncritical lists of foods eaten are available for most species, but there are few tabulations of foods refused, and still fewer analyses of preferred, seasonal, and staple foods. The drinking habits of many creatures are complete mysteries.

Cages should be small enough for easy handling and cleaning, and they should be furnished as simply as possible. For snakes, a glass-fronted wooden box, with a screen-wire, lift-up top, is generally most satisfactory. These boxes should be built in several sizes; a snake that usually rests in a five-inch coil does not require three square feet of floor space. Folded newspaper is one of the most utilitarian floor coverings; it is smooth and soft and can be replaced rapidly when it becomes wet or soiled. Minimum furnishings are a water dish large enough to permit the snake to immerse itself, a branch for climbing, and some type of shelter—a piece of cork bark is ideal but many substitutes may be used. Cages should be kept in a warm sunny place, but shade is as necessary as sunlight. Snakes regulate their body temperatures by basking for awhile and then retiring to shelter to cool off. Ten minutes enforced exposure to a midsummer, mid-day sun is often fatal.



The pilot blacksnake is easy to feed and care for.

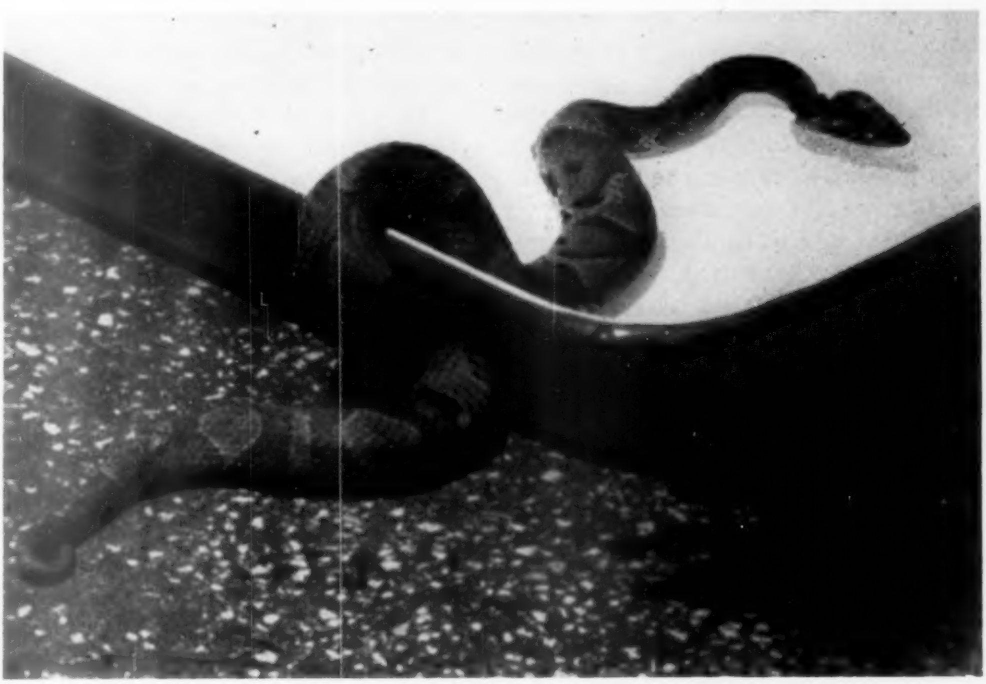
Never keep more animals than can be cared for properly. Three or four specimens in fine condition make a better impression and are better teaching exhibits than a dozen half-starved victims. If your zoo becomes crowded, mark the local specimens if possible and release them in a suitable habitat in or near the campus. Wise teachers often keep a land turtle for a month or so, release it to find its own food and winter quarters, recapture it the following spring, and repeat the cycle. Where box turtles or wood turtles are moderately common, each individual on a campus should be numbered by notching or drilling a hole in a particular marginal scute. Then as each is apprehended it can be remeasured, reweighed, and released if unwanted.

The following list is by no means a complete roster of hardy amphibians and reptiles. I have chosen as representative of each native order one or two species that adapt themselves to captivity; many other species would be equally satisfactory. The order of arrangement is not taxonomic; it is in descending order of human interest, an entirely unscientific "Hooper rating" based upon visitors' reactions to my changing laboratory pets.

The first requirement for a classroom snake is that it be harmless. Some readers, I am certain, will accuse me of being over-cautious and will testify that they have kept poisonous snakes for long periods without incident. Even they will agree, however, that among ten biology teachers there may be one absent-minded enough to forget to lock a cage occasionally, and in a hundred there may be a show-off. Or, the teacher may be ever vigilant and a cleaner's mop handle may break a glass cage accident-

ally. One copperhead loose in a school can start such a wave of hysteria that the school board loses all sense of proportion and passes an edict forbidding the keeping of *any* live animals. A few years ago a visitor wandered into a university laboratory, pried open a locked cage, and poked a rattlesnake with a ruler to see what would happen. It did! Of course my warning is aimed at the high school biology classroom and the beginning zoology laboratory; advanced college classes may have occasion to study poisonous snakes, and graduate students may require them for experimental investigations.

The second requirement is that the pet snake have a good, and preferably a rather undiscriminating, appetite. Students can learn more from a moderate-sized, nondescript, phlegmatic gorger than from a large, fancy species addicted to hunger strikes. In many localities the lowly garter snake is the best species to keep. It eats earthworms, small toads, and frogs with equal avidity, and in winter when these are hard to come by it will usually accept chopped fish or meat, especially if previously trained by having been offered these mixed with earthworms. In early spring ask your students to bring in every garter snake they find, so that you may select several large, gentle individuals with good appetites. A well conditioned garter snake, placed on a newspaper-covered table in the midst of a class, should be oblivious to everything but the handful of night crawlers with which you confront it. One or two large garter snakes can generally consume all the earthworms the average class is energetic enough to dig. A really large specimen is apt to be a female, well along upon the road to motherhood. The late summer birth of her brood, although possibly trying to teachers in adjacent rooms after some of the tiny



Copperhead—not recommended for the classroom use.

The spring peeper, *Hyla crucifer*, singing his spring song with plenty of pressure on his vocal sac. Photo by R. L. Coffin.

youngsters have escaped, as they generally do, will provide an excellent demonstration of ovoviviparity and will impress upon the students that garter snakes have large families—up to 78!

The well-populated classroom zoo must have at least two anurans; a toad and a tree frog are the irreducible minimum. The toad should be a large matron of a locally common species, for in toads placidity and girth appear to be correlated. About two years ago one of the members of our herpetological staff at the Carnegie Museum, Miss Dorothy Long, returned from her vacation with an unusually large American toad. "Winnie" soon made herself at home in a folded piece of heavy paper beneath a bookcase and since then she has had the freedom of the laboratory. She gets underfoot only when the pangs of unsatiated appetite or the balmy air of spring make her restless. So far as appetite is concerned she is indubitably gourmand rather than gourmet, for she has obligingly eaten every moving thing that she could pick up with her rapidly flicked tongue, and her record banquet was 152 Mexican bean beetles within an hour. Earthworms and meal worms are her usual fare but salamanders, cicadas, black widows, millipedes, praying mantis, and many insects have been eagerly lapped up, and only eight-inch long young snakes have proved too much for her enfolding tongue.

The tree frog may be any species of the genus *Hyla;* in the northern states the gray tree frog, *H. versicolor*, is best, and in the south the green tree frog, *H. cinerea*, is excellent. Tree frogs are famed for their homing ability and after a specimen has become accustomed to captivity it may be allowed to live uncaged among potted plants, from whence it will probably roam to an uncovered aquarium or to the laboratory sink when in need of water. Unlike the toads, tree frogs eat by grasping the food in their jaws, so they soon learn to accept meal worms or other tidbits from forceps or fingers. For variety, however, they should be caged with flies and other soft-bodied insects from time to time and forced to stalk their prey. Captive males of most species call frequently on moist, spring days, and occasionally at other seasons when stimulated by building vibrations from a passing freight or by certain rhythmic sounds. If fed at least once a week and provided with an always moist, moderately cool refuge, a tree frog should live for five to fifteen years in captivity.

To represent the ancient order of turtles I strongly recommend a tough adult rather than a delicate little hatchling. The box turtle is the most usual and perhaps the most dependable turtle pet, but I have a personal fondness for the wood turtle. Frequently, a fasting newcomer may be persuaded to eat by offering it a piece of banana, a fruit greatly relished by many kinds of turtles, or by caging it with a turtle that is feeding readily upon fruits, berries, lettuce, or raw meat.

Eventually every biology teacher is offered a young alligator that has suddenly seizing put an end to teasing by the tormenting finger with 80-odd needle-sharp little teeth. Kept at 70 to 80° F., provided with four inches or more of water and a basking rock or

Diorama of the life cycle of the frog.

log, such offenders often become docile, feeding twice weekly in warm weather and fasting during the winter. Small alligators are useful for demonstration of tonic immobility following stroking, and they hiss when annoyed and grunt in response to various stimuli, but I have yet to encounter one with real personality.

Lizards are more intelligent than most reptiles, and I recommend them highly as pets for the discerning fancier. In the classroom, it must be admitted, they lack the popular appeal of snakes. They are so active that they are prone to escape, and their requirements vary so greatly that general recommendations are of little value. My own favorite native lizard pets are the hardy skinks, but two other types merit mention because of the frequency with which they reach the classroom.

When a circus comes to town herpetologists' telephones shrill incessantly as young and old, arriving home with anoles tethered to pins, awaken to the realization that they do not know how to care for lizard pets. These little tree-climbers, usually from southern states, are often miscalled "chamelons," because they are capable of rapid color change in response to temperature, excitement, or light. They may flourish if released on plant bedecked sun porches or window ledges to stalk flies, insects, and spiders. Unhappily, most captive anoles die of thirst because they have never learned to drink water, and their owners are unware that they are accustomed to lapping droplets sprinkled on leaves.

The Texan horned lizard generally has a far shorter life as a pet than the credulous attribute to it in cornerstones. Unless ants are provided in quantity and both water and sunlight are readily available, captives slowly weaken and die.

The red-spotted newt, although not a spectacular performer, is one of the easiest salamanders to keep in the classroom. The immature, terrestrial red eft will live unobtrusively in a moist terrarium, feeding upon Daphnia, white worms, small earthworms, sowbugs, snails, and spiders, and occasionally posing its orange-red body spectacularly upon a clump of green moss. The green-sided, yellow-bellied adults flourish in balanced aquaria, swimming gracefully among the plants. Both sexes should be kept, for if conditions are satisfactory it may be possible to observe courtship, spermatophore deposition, and egg laying; and, in any event, the specimens may be used to illustrate secondary sexual characters. Except in winter when aquatic newts often fast, white worms, tubifex, small earthworms, or chopped beef, liver, or fish should be fed every other day. Since over-solicitous students can upset a balanced aquarium by dropping in too much food, some teachers remove the newts to small glass dishes for feeding.

I can think of no more appropriate way of ending this brief discussion of herpteological pets than by paying tribute to one of the nicest guests I have ever entertained in my laboratory cages. From 1936 to 1943 the prize pet of my laboratory was a seven-foot indigo, or Florida gopher, snake. Victor, as this blue-black giant was called, made up in immaculate shininess, impressive girth, and docility of manner for his limited I. Q. He would eat almost anything zoological at almost any time, from birds that committed suicide by flying against museum windows to large hunks of beef that I purchased from butchers who always looked at me askance when I requested dog meat for a snake. Victor's real preference was for food frequently and in quantity, but if he had any specific preference it was for snakes. Although we never offered him a poisonous snake, upon which his kind feeds readily, he proved on numerous occasions that large harmless snakes, including king snakes, were powerless to resist his attack. Ordinarily docile, indigo snakes have too powerful a bite to be kept as classroom pets for young children, and even Victor misbehaved once. A young snake fancier played with some garter snakes, and then, without washing their odor from his hands, opened Victor's cage when my back was turned. Although I disengaged Victor at once, a lacerated hand taught the boy the wisdom of washing food odors from the hands before handling any pet snake. One autumn I returned from a trip to find the following note upon my desk: "On the morning of Wednesday, September 1, 1943, death—as it must to all snakes—came to VICTORINE, long known as VICTOR, the pride and joy of the Carnegie Museum Herpetology Department."

Biology Laboratories is the feature which replaces the former by the way column. It will be somewhat broader in scope and will perhaps include some longer items. It is being conducted by former president and long-time booster of the Association and the Journal, M. C. Lichtenwalter, *5061 North St. Louis Avenue, Chicago 25, Illinois.* Like its predecessor, this column can be successful only if many people send in suggestions, so if you are interested in keeping the feature going, send items for it to Mr. Lichtenwalter.

Methods In High School Biology

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If variety is the spice of life, then diversified teaching techniques are the pedagogical ingredients which create and maintain interest in the Biology classroom and laboratory.

The writer has utilized the following teaching methods or techniques to motivate, demonstrate, illustrate or introduce some phase of biology to high school students: (1) lecture, or direct didactic presentation; (2) formal recitation, in which the teacher demonstrates with experiments, chart models, or dissection; (3) audio visual aids, using movies, slides, charts, blackboard diagrams, and film strips; (4) supervised or directed study; (5) biological projects and problems with full student participation; (6) student motivated research; (7) laboratory work where the students are taught basic motor skills, use of microscope, etc. with individualized instruction in developing techniques; (8) rote methods for memorizing definitions, or principles; (9) topic development, through special student oral reports; (10) argumentation and debate lessons to emphasize student participation; (11) assigned home projects such as home seed germination; and finally (12) tactual and auditory techniques specially adapted for blind students.

In recent research literature abundant statistical data indicate generally that the highest test scores were obtained in equated groups where teacher demonstration techniques were compared with other classroom procedures. Visual methods were generally better than non-visual, In order of achievement scores in biology the six most commonly used methods were: (1) teacher demonstrations, (2) visual presentation, (3) drill or rote, (4) formal recitation, (5) formal laboratory work, (6) lectures or didactic presentation. It should be noted, however, that these objective, achievement type tests in biology did not evaluate (1) appreciation, (2) transfer values, (3) interest, (4) or future vocational motivations.

The motivation thesis for all teaching techniques or methods in biology is interest.

Lecture Method

The lecture method is the most commonly used in high school and college, having several advantages: It presents many ideas in a short time, and is, therefore, an economical method of instruction. The lecture may be used for large groups of students, including assemblies, and also to present utilitarian or basic material. Lectures are usually used as an introduction to directed discussion, serving to introduce teacher demonstrations or laboratory exercises in the biology classroom. Lectures summarize material rapidly, especially in review of topics such as conservation, forestry, photosynthesis, and ecology. It should be noted that if the instructor talks faster than 160 words per minute the average student cannot keep pace with him. Brief pauses are therefore advisable in the course of presentation.

* While this paper was written the author was a graduate student in science education, Johns Hopkins University, Baltimore, Maryland.

Formal Recitation

The formal recitation or directed discussion method is still the mode of choice in biology classes to develop subjects. The instructor should control the class discussion so that the recitation proceeds smoothly, keeping to the main topic or the objectives of the lesson plan. Thought provoking and purposeful questions, which are clear cut and motivate appropriate response should be utilized in this type of lesson. It is also a good practice to get students to answer questions presented by any other student. In biology the recitation is an excellent method for presenting the content of a carefully planned directed lesson plan. The recitation too, is the best check on home assignment preparation by the students. At beginning or end of each period, the home assignment should be explained to the class and its importance emphasized.

Laboratory Work

Laboratory work stresses and tends to develop motor and sensory skills, coordination and technical abilities. "Learning by doing" is one of the axioms in this method. It is used when exercises are short and can be mastered by the student working mainly on his own initiative. Lab work takes care of individual differences, when students may get some personal instruction. Ability in the use of the microscope and other biological apparatus, dissection skill, manual skill in first aid, interpretive drawing and experiments are desirable outcomes.

Socialized Recitation

Socialized recitation had its place in teaching biology to develop leadership, poise, confidence, self expression and oral discourse ability. The method may be used for general topics in biology covering easy material such as: biology in industries, forestry, forest conservation, the economics of plant and animal life, and the biographies of scientists. This method is an excellent teaching device for bright or average classes but is of doubtful value for groups whose I. Q. is low, as the lesson may become dull and uninteresting due to inadequate student participation, or poor oral presentation.

Project and Problem

Project and problem methods promote constructive, creative, and reflective thinking; teaching students to work in coordinated groups. It is advisable to give students with high I. Q.'s the more difficult problems. Topics such as plant ecology, erosion, soil fertility, conservation of natural resources, economic importance of plant and animal life, life cycle of human tape worm, etc., may be taught by this method. Special projects such as a student-run hydroponic garden in which they grew soilless plants, particularly vegetables, proved so interesting that the public was invited to view the exhibits.

Drill or Rote Methods

Drill or rote methods are of value in some phases of biology instruction, in fixing the responses which involve learning processes acquired through repetition. The teacher should vary drill techniques and procedure to prevent boredom and fatigue. Drill techniques are used to advantage in preparing for objective type tests, city or state wide; Board of Regents examinations; and college entrance aptitude examinations. Because achievement tests play on words, frequent drills in biological nomenclature, definitions of scientific terms are worthwhile; especially in such topics as cell structure, mitosis, Mendel's law of inheritance, chemistry units, and in classification of plants and animals.

Directed or Supervised Study

Students should be taught how to study and prepare assigned lessons, first by making a study program; relating old to new assignments; secondly, learning to take notes systematically; third, using diversified methods in problem solving; fourth, learning how to outline text book lessons; fifth, practice in making summaries of units or topics in the daily assignment; sixth, by developing a problem solving attitude; seventh, learning by wholes which is an advantage in memorizing short passages by rote; eighth, determining the meanings of concepts and terms in biology; ninth, using meaningful inductive methods utilizing experience concepts in which the student applies his knowledge directly to the lesson or topic.

In directed study techniques it is advisable to start out with easy material which students can comprehend, and gradually work up to difficult concentrated topics. Finally the directed study is followed by spirited recitations with the lesson objectives emphasized throughout the period.

Teacher Demonstrations

Teacher demonstrations and experiments may be used to present a lot of practical data economically, and when material or apparatus is too expensive or too dangerous for individual use. The demonstration material should be large enough to be shown at a distance, and visible to the students in the back of the room. Because students often make mistakes when apparatus is used by themselves in the laboratory, teacher demonstrations present a more accurate picture. The method is used when learning is difficult and complicated. A good teacher's demonstration arouses and maintains interest by appealing to all the sense perceptions, visual, and auditory; olfactory in chemistry units; and the tactual sense particularly for the blind students.

Puzzle Diagram

Puzzle diagram solution applies to biology instruction when charts or diagrams in the text require reflective thought for correct interpretation. Such diagrams may be utilized for student demonstration on the blackboard, in which the student draws the puzzle diagram on the blackboard and then explains it before the class. Examples of topics suitable for this type of lesson include the oxygen, carbon and nitrogen cycles, photosynthesis, heliotropism, plant circulation, etc. Biological drawings made and labeled by students tend to visualize and increase the retention of useful information. Visual perception, and recall of imagery are positively correlated, especially where diagrams or illustrations are necessary to content mastery or comprehension.

Field Trips

Field trips are usually extra-curricular activities in the average high school, nevertheless, the school campus or adjacent country may be used by biology classes for tree identification, insect collections, study of weeds, flowers, seeds and seed pods. Field trips in biology bring the forest, field, stream, farm, the local health departments, dairies, food packers, and the filtration plant, etc., as direct transfer values to the classroom and laboratory, for discussion and utilitarian applications.

Visual Methods

Visual methods models, film strips, charts, steroptican slides, and actual prepared or living specimens are valuable supplemental or enrichment devices in

teaching biology. U.S. Army psychologists claim that 85% of perceptual learning takes place thru the eyes, reading of course being included. Premotivation with a preliminary talk is pedagogically essential for any film showing if maximum learning is to be attained. Also free classroom discussion, an objective or subjective test following the film showing, is necessary to complete a good visual lesson with understanding of the content. Repeat showings of films which are biologically significant is advisable. It is good practice to turn off the sound for the second repeat showing, when as an oral recitation the students explain the film content during silent projection.

Literally thousands of free films are now available for distribution to public and private schools. Many war time films definitely have peace time value. In biology, the Army films on malaria—particularly Walt Disney's colored film entitled "Anna and the Seven Dwarfs"—first aid, hygiene, military sanitation, insect vectors of disease, water filtration and food preparation are ideal for high school and college use. The film industry itself could prepare to advantage lists of films suitable for use in the various high schools and colleges.

Film libraries for school systems should be as readily available for class room use as are the reading libraries.

In controlled objective experiments, on delayed recall tests, there was a 38% superiority in film groups as compared with final recitation. Visual methods are generally less effective for theory and abstract material, but for practical subject matter the films indicated better results on achievement ratings.

Student Motivated Research

When thought provoking questions are asked for which there is no apparent answer, the stage may be set for a student participated research problem. Could a dirty, much used book, for example, which has been sneezed or coughed on, harbor or disseminate bacterial or viral communicable diseases? This question started an original research problem in the author's biology classes in which the pages of scores of books, magazines and newspapers obtained from various sources, were cut to uniform size, washed in sterile water and the wash water plated on nutrient and blood agar culture media. Total and differential bacterial counts were made and the results tabulated. Successful publication in educational, medical and science journals, with editorials and comments in newspapers all over the country followed. The project was obviously worth the time and effort devoted to it with the students benefiting by participating in simple research methods.

Students injected chlorophyll into bracket fungi to see if the photosynthesis process could be created in these non-chlorophyllic plants. The action of cold light on photosynthesis of plants was attempted experimentally in a dark room in the presence of fire flies as the only source of light when this unanswerable question came up for discussion in the classroom.

Pimples bother many adolescent pupils and may result in antisocial and introversion complex tendencies. In a student requested and motivated project, we analyzed wash water, from pimple pus, shaving brushes, razor blades and secretions from a pimply faced pupil. The facial skin bacteria such as staphylococci, stretococci, bacillus acne, and other dermatrophic organisms were isolated and differenitated. Some preventive and remedial measures and prophylactic procedures were suggested for adolescent skin blemishes. The results proved interesting and were published in scien-

tific and educational journals with nation wide circulation.

Argumentation and Debate Lessons

These are valuable aids to provocative thinking in developing self-expression, self-confidence, and egocentric tendencies in individual students. Debatable topics such as heredity versus environment as applied to marriage, criminology, plant and animal breeding, and hereditary diseases are interesting, particularly near the end of the year's work in biology, when students have come biological concepts for presentation. The text book may suggest several debatable or deductive topics for discussion and debate lessons. Arguments for and against the local passage of laws for conservation of our natural resources make good debate topics which might well affect the prosperity or well being of any community.

Tactual and Auditory Techniques

Faced with a problem of teaching blind students along with their seeing colleagues, the writer developed with class cooperation, tactual and auditory devices for their special use. Braille texts in biology general and science were prepared in cooperation with the Maryland School for the Blind. To teach chemistry fundamentals, cut out braille labeled geometrical figure blocks were designed so that when fitted together formulas and equations were made tactually. The teaching device now manufactured for seeing students as "Valence Blocks" and chemical illustrators started as a student motivated project.

In biology for the blind, plaster models replace microscopes, cut out diagrams replace charts, and impression diagrams become illustrations for tactual interpretation in their own text books. The blind prepared braille biology notebooks, took objective tests, performed anatomical studies on large specimens, and generally perform their tasks, utilizing manual, olfactory, tactual, and oral skills. Blind students may now enter regular public or private high schools, study the same curricula, and take their place with the seeing.

Vitalized Biology

To vitalize instruction and keep biology up to date and interesting, pertinent articles found in the *Reader's Digest, Reader's Scope, Science Digest, Science Illustrated, Coronet, Life* and other magazines may be presented for class room discussion. Assignments on streptomycin, insulin, cancer, viruses, D.D.T. and reproduction were recent topics which were discussed and analyzed in biology classes. Science reading ability is one of the major objectives in biology. To accomplish this, we gave frequent home assignments with completion tests as a check on accurate reading and interpretation, and also single sentence summaries of assignments to express concrete thought. Outlining each paragraph in the text is an excellent teaching device used extensively in the social sciences; it could be used to advantage in biology assignments also. We teach American Red Cross first aid, as part of the practical application phase of the human physiology unit, as a strictly utilitarian objective using the first aid text and current articles.

Much outside reading is positively correlated to science subject matter. In a statistical survey of magazines, biological articles led all others in frequency of publication.

A Plastic Warming Chamber For Biological Laboratories

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Introduction.

It is a difficult procedure to maintain mammalian tissues for observation over a period of several days with the equipment available in the average biological laboratory. The standard equipment for this type of observation is expensive and the results do not justify the expenditure. It would seem beneficial to devise equipment by which tissues could be observed macroscopically and microscopically that would be within the range of a biological laboratory budget. Such equipment would be even more useful if stimulation and various solutions could be applied to the preparation without disturbing it. This report is an attempt to describe a warming chamber which is inexpensive and easy to make and will fulfill the requirements mentioned above.

Materials and Methods.

A piece of lucite[1] no larger than 25 centimeters square and 4 millimeters thick is ample material for construction of the chamber. For the accessories the following materials are needed: a piece of glass tubing 25 centimeters in length, with a diameter of 5 millimeters, two telephone jacks and receptacles, and two lengths of fine wire.

Any type of warming device desired can be used. The chamber described herein was designed for a microscope stage incubator[2] which fits the mechanical stage of a standard microscope. If a dissection microscope is to be used with this equipment, the metal clips can be bent to hold the warming stage securely. This type of warming stage can be regulated so that the effects of temperature variation can be observed, or the stage can be maintained at a constant temperature for long periods of time.

The warming chamber was prepared as follows: a floor 7.5 centimeters by 2.7 centimeters and 4 millimeters thick was cut from the block. To this floor sides 5 centimeters long and 1.5 centimeters high were fastened. This left a space 1 centimeter long at one end and a space 1 5 centimeters long at the other.

A box to hold the jack receptacles was constructed on the larger end. This box had sides 4 centimeters in height and was capped with a small piece of plastic. Holes of suitable size were bored in the roof and the receptacles were bolted firmly to it. See Figure 1.

The smaller end was utilized for the glass tube through which solutions were forced into the chamber, and through which the second electrode wire passed. See Figure 2. The other electrode passed directly from the box containing the jack receptacles to the chamber. See Figure 1. A plate of plastic 3 centimeters wide and 5 centimeters high with a notch in the top was fastened to the end of the stage to support the glass tube. See Figure 1.

1. Lucite, a plastic material, is manufactured by Rohm-Haas Company, Philadelphia, Pennsylvania.
2. Microscope stage incubators may be obtained from the Fisher Scientific Company, Pittsburgh, Pennsylvania.

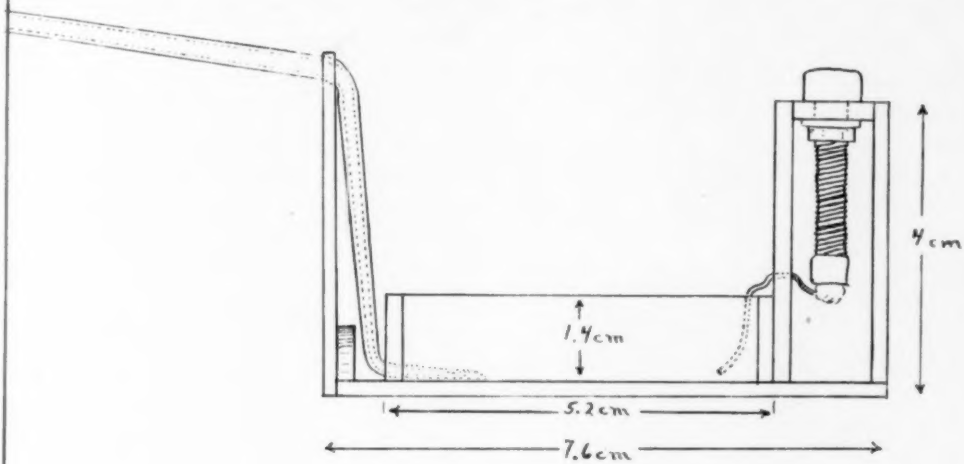


Figure 1

Side view of warming chamber

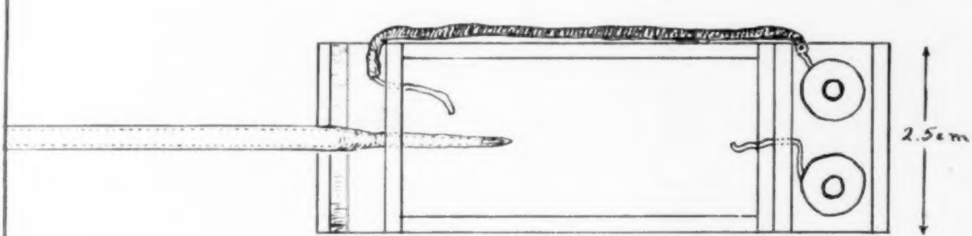


Figure 2

Top view of warming chamber

Cementing of the parts was accomplished by moistening the edges to be approximated with acetone and holding the pieces firmly together for at least ten minutes. (If a vise is used, a firm union is assured.)

The wires leading into the chamber served as electrodes. The tissue was fastened to these wires by capillary forceps or tied by means of fine thread or wire.

If the preparation was to be maintained for a length of time exceeding two hours, it was found desirable to cover the warming chamber. A cover was made from a piece of plastic 5 centimeters by 2.7 centimeters.

A chamber with these dimensions

fitted closely into the microscope stage incubator which was affixed to the microscope. See Figure 3.

It was ascertained that visualization was adequate up to magnifications of ×100 on the standard type of microscope. This is, of course, sufficient to handle the magnifications of the dissection microscope. If magnifications greater than ×100 were desired, it was necessary to construct the chamber on a 3 inch by 1 inch glass microscope slide, or to remove a section of the plastic bottom and to substitute optical glass. This was necessary as the plastic produced optical distortion at higher magnifications. It was more difficult to construct the chamber with the glass bottom and it was easily broken.

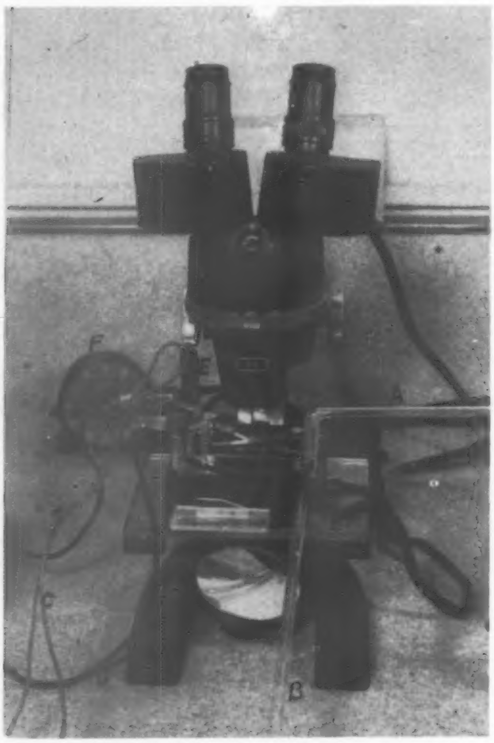


Figure 3. Warming Chamber Assembled.

A. Glass tube leading to the warming chamber.
B. Thermometer to the microscope stage incubator.
C. Wires to the jacks from the inductorium.
D. Wire to jack from the galvanometer.
E. Jacks fitted to the warming chamber.
F. Timer which may be included in the circuit.

The warming chamber fits into the microscope stage incubator which in turn is fastened to the glass stage of the dissection microscope by means of clips.

Stimulation was furnished either by means of an electronic stimulator by which duration, intensity and frequency could be controlled or by means of dry cells attached to an inductorium. When the latter was used a galvanometer was introduced into the circuit at the bottom of the jack receptacle and the amount of stimulation measured.

Summary.

Standard muscle preparations of mammalian tissue have been maintained for several days, the solutions were added to the chamber through the glass tube.

It is possible to fix the tissue by perfusion by adding the fixative through the glass tube. The same is true when intra vital staining of tissue is required.

The plastic material is easy to manipulate. Tools required to build the chamber as described were a hack saw, files and drills. The material is durable but, like glass, will shatter.

Plastic materials scratch easily. If, in the preparation of the slide, scratches are made on the optical portion of the stage, they may be removed by coating evenly with liquid plastic, such as clarite.[3]

3. Clarite may be obtained from the Central Scientific Company, Chicago, Illinois.

The Teleological Approach in Botany

KENNETH E. WRIGHT
Smith College, Northampton, Massachusetts

One of the most unusual examples of teamwork in nature is the pollination of the yucca flower by the Pronuba moth. In the pistil of the yucca flower the stigmatic surface is internally located at the base of a tube-like style. The only insect which can effect pollination in this plant is the Pronuba moth. After drilling a hole through the ovary wall and depositing her eggs among the ovules, the female moth with her specialized mouth parts collects pollen and forces it down the style tube to the stigmatic surface at the bottom. In this manner pollination is accomplished and fertilization made possible. After yucca seeds begin to develop from the ovules the young larvae eat the seeds, the only source of nourishment which will sustain them. However, not all of the seeds are eaten, such abstemiousness assuring a succeeding generation of yuccas. The whole process seems all the more remarkable when we realize that the moth dies soon after laying her eggs and never sees her progeny. It is no wonder that this series of events and many more such adaptive processes and structures in the plant and animal kingdoms lead the human observer into a teleological explanation of various life phenomena.

Primarily because of their lack of understanding it was the custom of primitive peoples to personify most of the objects around them, whether animate or inanimate. Explanations became easy when an aborigine endowed his surroundings with the same characteristics which he himself possessed or thought he possessed. Today man for the most part has passed beyond the point where he tends to personify the inanimate, but in the field of biology he often persists in maintaining such concepts. For example, flowers are colored to attract insects; plants bend toward the window in order to get more light; thorns are for the purpose of protection against predators; roots grow down into the soil to seek water. All of these statements imply purposive action,—action taken in consequence of thoughtful planning. In popular publications this "for the purpose of" language is quite common, and all too often it permeates our textbooks and characterizes classroom discussions, even to its rather extensive use by many instructors.

"Flowers are colored to attract insects" and "colored flowers attract insects" may seem to be just a prestidigitator's exercise in semantics. However, the first quotation is teleological, and the second is merely a statement of fact based on experimental evidence. There is a rather fine shade of difference in the words used in these two quotations, but there is a vast difference in philosophical implication.

If plants were so cognizant of future needs that they planned colored flowers to attract insects for purposes of pollination, then thousands of plants did some needless labor. Fertile seeds of the violet are produced in cleistogamous flowers and not in the showy blue blossoms which we admire. In the yellow dandelion neither pollination nor fertilization is necessary as the eggs develop parthenogenetically. There are numerous beautiful flowers in which pollination is accomplished by wind, water, or grav-

ity,—physical forces which are entirely divorced from the influence of any color as an attracting agency.

If the staunch supporter of the color-insect thesis is confronted with such non-conforming examples as those just cited, then another convenient "why" for the color of flowers is "to make the world beautiful for man." This egocentric point of view has been instilled into us since childhood. Man is the king pin, and all other living things are for his especial benefit. The multicolored blossoms again must have been rather astute in planning for man's future pleasure as they arose in the evolutionary sequence long before the advent of man.

"Plants placed in a window bend toward the source of light" is a simple statement of fact which has no inference concerning any willful action on the part of the plant. How much more logical it is to search for cause and effect relationships in an attempt to ascertain the reason or reasons for such a response to light. Experimental investigation would reveal that cell divisions and elongations on the side of the stem exposed to higher light intensities are retarded, and as a consequence the plant bends toward the source of light. We could determine further that the light affects the water content of the cells and the synthesis and translocation of growth regulating hormones. We are all familiar with the fact that light will influence chemical reactions as in photographic films exposed to light. Although the ultimate answer to the effects of light on the complex chemistry of the plant has yet to be found, we have no reason to assume that the problem is incapable of solution, and that the plant in some mysterious way has the power to govern its own activity.

For the purpose of carrying this discussion a bit further let us assume that at this point the reader is in agreement with the proposition that the plant is incapable of purposive behavior. There still remains the possibility that some over-all force competent of carrying out a design in nature may be involved. On this assumption many teleological statements, such as "flowers are colored to attract insects", could well be true. To prove or disprove such a belief by mundane experiments in the laboratory is not possible, but we can make certain observations in nature which may be relevant.

The casual observer is usually impressed by likeness in nature, such as the resemblances between the leaves of the black oak tree and the red oak tree. However, closer scrutiny discloses leaf variations so extensive that even the experienced botanist may be unable to sort out a given quantity of leaves from these two trees into their proper specific categories. Variations in ancestral plants through millions of years have culminated in present day recognizable species of plants. From the point of view of survival these variations may be favorable; they may be of no significance, or they may be of distinct detriment.

Variations which are advantageous in relation to survival constitute the chief bulwark of the teleologist. The remarkable dovetailing processes as in the yucca and Pronuba moth life cycles seem to preclude all possibility of chance variation as the method of arriving at such perfect synchronization. Fortuitous circumstance could not possibly arrive at such delicate adjustments; therefore there must be some guiding influence which directed and brought about this high degree of adaptive specialization. All well and good, but what about the

answers to the "why" questions involving other kinds of variations: those without significance, or those of distinct disadvantage as far as survival is concerned? These latter variations are usually blithely ignored by the teleologist.

Of those variations which have little or no survival value certain leaf characters may be given as examples. Leaves may be linear, lanceolate, elliptical, ovate orbicular, acuminate, acute, cordate, obtuse, entire, serrate, dentate, crenate, undulate, lobed, glabrous, puberulent, pubescent, villous, complete, incomplete, sessile, simple, compound, pinnate, palmate, digitate, alternate, opposite, whorled, deciduous, evergreen. The teleologist might well ponder the "why" of these variations which have arisen through the ages, as it would be difficult to assign any utilitarian advantage to many of them.

How are we to explain variations which may be of distinct disadvantage as far as survival is concerned, or which may even be lethal? Germination of seeds may be hindered or made impossible by physical obstructions or by the presence of chemical inhibitors. The teleologist who is consistent in his explanations must say that this non-adaptive situation is a part of the great design, however unfortunate the consequences. In chlorophyllous plants there may be a heritable factor for albinism which condition when evident in the plant results in death. Since death is the result of a combination of lethal factors, then the teleological explanation is that such a sequence of events follows a chartered course and extinction was planned. Such catastrophies to the lowly plant may not be particularly upsetting or repugnant to the teleologist, but when similar situations arise with the higher animals, including man, one might well pause for a moment and recheck his teleological concepts.

Man has a tendency to explain *why* without knowing *how* natural phenomena take place. His "why" explanation usually involves the acquisition of structures and processes by the plant on the basis of need, regardless of the fact that this type of explanation often leads into a blind alley. The careful student of plant development realizes that the plant of today is the result of untold variations which have occurred in the protoplasm of its ancestors, such variations being independent of the needs or desires of the present day plant. He looks for causes regardless of the fact that the observable result may be good for the plant or may be bad for it. Only by such painstaking investigation into the causality of events will we add to our present rather meager knowledge of the underlying principles which govern plant processes. The teleological approach would appear to be a highly questionable substitute as a method of explaining plant behavior.

BIOLOGY LABORATORIES

Microscopes are now available. The newer models have some refined qualities not present in prewar models. In an early issue of "Biology Laboratories" I want to report to you an interview with a man that specializes in cleaning, repairing, and rebuilding microscopes and related optical instruments.

Are you interested in making a little money on the side for your biological knowledge? There are a number of different methods. Collecting is one method. Most every community can contribute something. Kinds of material are often seasonable, that is, found only during a particular season; however collecting is not seasonable. There are materials

to find the year round. It is not the business of this biology laboratory column to list specific items but if you will drop me a line I can indicate what is seasonable and perhaps find you a market for it. Collecting experience is not necessary but a will to collect is important.

SPEAKING OF MICROSCOPIC SLIDES, ground bone slides are sections of bone ground to about three thousands of an inch thick. You can read news print thru the sections. The paper cover on an ordinary book of matches is about six times this thick. Sheets of the bone warp like a damp piece of paper.

PHYLLIS LARSON, teaching next door to my room has an experiment that is creating interest in her classes. She has two containers with glass sides close together. With these narrow containers her students are checking the growth rate of beans in one and corn in the other. The seeds are growing in moist peat moss. I asked one of the boys what it was all about. He was prompt with an informative answer. Try this on your spring classes. Yes, she had a duplicate of the experiment on the far side of the room. These were growing toward the light.

HAVE YOU TRIED the germination and growth of albino corn. This experiment is excellent for the genetic ratio—albino vs green. Some come thru pure white. Albino corn comes white and is devoid of chlorophyll. Don't parley the experiment too far for the albino can not manufacture its own food material for growth.

WHAT DO YOU DO with animals that die in spite of the best care that you are able to give them. If you wish to preserve these place them in a 10% solution of formaldehyde for a day or two then change them to a 5% solution for storage. It is best to open the abdominal cavity to permit the fluid to enter. Use a small incision or inject the body with the solution by using a steel pointed syringe.

IN THE EVENT that you are going to discard the animals, open up the digestive tract and you might find an abundance of parasites much to your surprise. Wash the tract out throughly with quantities of water. Wash in several changes of water any parasites which you find. Fix them in a good fixing solution and store in formaldehyde or 70% alcohol.

A storage solution is 5 to 10 parts of ordinary glycerine added to 95 to 90 parts of 70 percent alcohol. Shake before using. Keep tightly sealed as the alcohol evaporates faster than water. Even if both water and alcohol evaporates tissues remain pliable with glycerine over the tissues. Mix up a quart of this solution and keep it in the laboratory, 30 cc of glycerine and 470 cc of 70% alcohol equals to about a pint and a half.

THIS IS YOUR column. Send in your tips to *Biology Laboratories*, 5061 N. St. Louis Ave., Chicago 25, Ill.

MENDELIAN LABYRINTH PUZZLE I

Somewhere in this maze of letters Mendel's Law of Dominance and his Law of Segregation are hidden—and it's up to you to find them. The only clues we can give you as an amateur Sherlock Holmes is to begin each sentence with the letter "I" where it says "Start Here" and finish with the large "S" near the center. You must use the letters in the order in which they occur, without skipping letters or jumping across a space, but you may go up, down, or across as is necessary. The lines below are for writing down the two laws which you will discover.

_______________________________________ This is the law of ________

____

____

_______________________________________ This is the law of ________

____

START HERE---- I

I	L	P	N	S	R	E	T	C	N	F	H	F	S	P	R	I	N	G	N	O
T		S		W				A		T		F				T		W		G
U		L	L	I	T	H	A	R	H	W	H	O	E	H	E	Y	W	I		H
P		L				C		Y	H	O		T		T				L		B
I	N	T	H	E	Y	E	G	B	G	S	P	E	G	D	G	O	N	L	C	O
G				O		H		R	I	D		C		E		T				M
R	P	S	F	F		T	T	U	H	S	E	I		S	H	B	H	E	L	P
I		G		H				B		A				S		R		T		S
N	G	A	E	A	R	E	H	E	H	R	E	C	R	O	G	E	A	E	L	Y
T		N		P		N		P				N				E		A		R
H	S	D		D	H	T	N	Y	T	O	T	E	U	R	T	D		E	S	E
O				N			S			S		N		V				M		A
W	T	H	B	A	H				H	O	H	C	N	E	H	T	H	B	L	E
T		E		R				R		F		A		O		R				O
P	Y	T		G		C	T	E		I	G	E	H	T		O	T	N		N
E				E		A				T		N		H				E		E
S	O	F	T	H	T	R	A	H	C	S	Y	I	R	E	P	O	H	R	A	P

The above puzzle was submitted by S. M. Pattee, Cedar Rapids, Iowa, high school biology teacher. It is one of a series developed and copyrighted by him. Anyone interested in other similar puzzles or in receiving the answer to this one may address S. M. PATTEE, *Roosevelt High School*, Cedar Rapids, Iowa.

Annual Convention of the

NATIONAL ASSOCIATION OF BIOLOGY TEACHERS

in conjunction with

The American Nature Study Society and The National Science Teachers Association Washington, D. C.

MONDAY, DECEMBER 27

7:00 P.M. Business Session—Room 134, Washington Hotel

TUESDAY, DECEMBER 28

10:00 A.M. Joint Session—Hall of Nations Room, Washington Hotel, Panel Discussion: The Science Curriculum at All Levels of Instruction

2:00 P.M. National Association of Biology Teachers—Mural Room, Washington Hotel

Topic: What Current Health Needs Are Being Met Through Recent Research?

GEORGE M. LYONS, Atomic Energy Commission, Washington D. C., *Combatting The Effect of the Atomic Bomb and Atomic Fission on Living Things*

GEORGE B. DOWLING, National Blood Program, American Red Cross, *The Use of Blood and Its Derivatives in Restoring Health and Preventing Disease*

H. O. BURDICK, Alfred University, Alfred, N. Y., *The Use of Hormones in Glandular Imbalance*

RALPH B. WYCKOFF, National Health Institute, *Viruses as Revealed in the Electron Microscope*

7:00 P.M. Business Session—Room 124, Washington Hotel.

WEDNESDAY, December 29

10:00 A.M. Joint Session—Hall of Nations Room, Washington Hotel

Panel Discussion: Problems of Science Teacher Training

2:00 P.M. National Association of Biology Teachers—Mural Room Washington Hotel

Panel Discussion: Coordination of Health Measures in Schools

Discussion Leader: William Hughes, Temple University

Panel Members: Morey Fields, New York University, Walter E. Hager, Winson's Teachers College, Washington, D. C., H. E. Klander, Washington, D. C.

6:30 P.M. Joint Dinner of the three societies, Hall of Nations Room, Washington Hotel

THURSDAY, DECEMBER 30

10:00 A.M. Joint Session—Hall of Nations Room, Washington Hotel

The Third Annual Junior Scientists Assembly

2:00 P.M. National Association of Biology Teachers—Mural Room, Washington Hotel

Topic: How Can the Teaching of Health Become a Factor in the Improvement of Human Relations?

MRS. ALBERT MARTIN, Pittsburgh, Pennsylvania, *What Part Can Biology Play in Health Teaching?*

Panel Discussion: Respective Roles of Teachers, Nurses, Psychologists, Psychiatrists and Administrators in Maintaining Mental Health.

Discussion Leader: John E. Shoop, New Rochelle High School

CONVENTION INFORMATION

The 1948 meeting marks the first time the three major AAAS affiliates dealing with science teaching are holding a joint session. The general theme of the sessions is *Meeting the Needs of Society through Science Education.* As indicated by the program on page 192, joint sessions are scheduled for each morning, with the individual organizations holding their meetings in the afternoon. All of the programs of the individual societies will be printed in a joint program available at the meetings. Robert W. Lefler of Purdue University is the secretary of the cooperative committee of the three societies. The exhibits will be in the Hall of Nations Room of the Washington Hotel, in which the joint sessions and the joint dinner will also be held. Separate business meetings will be held on the evenings of the first two days of the convention. The American Nature Society will show Kodachrome movies and slides at its evening meeting on December 28. Additional information concerning the meetings may be obtained from the following individuals: for the American Nature Study Society, RICHARD L. WEAVER, Box 1078, Chapel Hill, North Carolina; for the National Science Teachers Association, MORRIS MEISTER, 315 Riverside Drive, New York City; for the National Association of Biology Teachers, RUTH DODGE, 490 Broadway, Dobbs Ferry, New York.

HOTEL INFORMATION

The headquarters hotels for the annual meeting are the *Washington* and the *Willard.* They are separated by less than a city block and are near the White House grounds.

The Washington Hotel will supply 100 double bedrooms with private bath at rates of $8 to $13 per day and 24 single rooms with private baths at the rates of $4.50 to $7.50 per day. The Willard Hotel will make a maximum of 125 bedrooms available at rates ranging from $4.00 to $7.00 single and from $6.50 to $11.00 double.

Members are to make their own arrangements with the hotels at least one week in advance of the meetings. All applicants for these rooms should indicate that they are attending the meetings of the *Science Teaching Societies* of the *AAAS.* Members should be encouraged to make arrangements to occupy double rooms.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946

Of *The American Biology Teacher,* published monthly October to May, inc. at Lancaster, Pennsylvania.

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher: BUSINESS PRESS, INC., Lancaster, Pennsylvania
Editor: JOHN BREUKELMAN, Emporia, Kansas
Managing Editor: IRVING C. KEENE, Brookline High School, Brookline, Massachusetts
Business Manager: *none.*

2. That the owner is:
THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent of more of total amount of bonds, mortgages, or other securities are:
None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear on the books of the company; also that the said two paragraphs contain statements embracing affiants full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear on the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN BREUKELMAN
Editor

THE CORNELL PLANTATIONS

The appointment of Dr. John Farnsworth Cornman as first director of the Cornell Plantations was announced at Cornell University by President Edmund E. Day. An assistant professor of ornamental horticulture at Cornell, Dr. Cornman will direct the project on a part-time basis. He will continue to teach in the College of Agriculture and to supervise the college's work in ornamental turf.

The Cornell Plantations—a unique combination of botanical gardens and arboreta embracing nearly 1,000 acres of trees, vines, shrubs, woody and flowering perennials—has been in development since the opening of Cornell University in 1868.

A master plan for development of the tract was drawn up in the 1930s and, with the assistance of the Civilian Conservation Corps, road, driveways, bridges and other engineering improvements were made. The name Cornell Plantations was adopted in 1944.

The garden and arboretum areas are supplemented by extensive laboratory and library facilities, a herbarium in the College of Agriculture, and the collection of palms and cultivated plants in the Bailey Hortorium—the only collection of its kind in the world.

A long-range development program for the Plantations calls for the integration of all Cornell land holdings with formally arranged botanical gardens and arboreta for testing and research. Other areas will be preserved in their naturally wild state.

Some of our readers are perhaps not aware of the fact that THE AMERICAN NATURE STUDY SOCIETY and THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS are regularly featured in a page in NATURE MAGAZINE. Summarized information concerning the Washington meetings of the two organizations appears on page 496 of the current (November) issue of the magazine.

CHANGE IN MEMBERSHIP DUES

Early in October our secretary sent the following letter to all members of THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS. This is the action of the Executive Board, authorized at the annual meeting in Chicago in December 1947.

Dear Member:

Due to the unavoidable increase in the cost of publishing our journal *The American Biology Teacher*, and due to the general rise in costs of all activities of our association, your Executive Board has authorized an increase in dues from \$2.00 to \$2.50 for U. S. and Canada. Foreign memberships will be raised from \$2.50 to \$3.00. Single copy price will be raised from 25¢ to 35¢.

Since our fiscal year begins January first, and also due to the reluctance of your Executive Board to authorize an increase in dues, your secretary has set December 1, 1948 as the date for the new rates to become effective.

New and renewal memberships postmarked not later than December 1, 1948, will be accepted by your secretary at the old rates.

MAIL YOUR RENEWAL IN NOW!

Enclosed you will find your ballot for the 1949 officers. Be sure to mark it and include your ballot with your dues.

If you have already paid your 1949 dues, do not fail to mail your ballot.

Sincerely yours,

JOHN P. HARROLD,
Secretary-Treasurer

HEALTH SCRIPTS

An educational series of 15-minute radio scripts, dramatizing public health problems, is now available according to an announcement by The Mutual Life Insurance Company of New York. The scripts will be released on a monthly basis through May and will be offered without charge as an educational service to teachers, librarians, club leaders, and radio stations.

Miss Gretta Baker, well-known script writer and former member of the faculty at New York University, will write the series for The Mutual Life, under the guidance of the company's medical department. In discussing the new series, Miss Baker said: "The scripts can be used on or off the air. They are simply written and easy to produce and make fascinating program material for club meetings, school assemblies, radio workshops, little theatres, and other community groups. Teachers of English, speech, dramatics, hygiene, and science will find the scripts especially helpful in classroom work." For free copies write to the public relations division, The Mutual Life Insurance Company of New York, 34 Nassau Street, New York 5, New York.

Robert H. Carleton, newly appointed executive secretary of the National Science Teachers Association has assumed office and field duties with headquarters in the National Education Association office building, Washington, D. C. He left his position as assistant professor of physical science, Michigan State College, East Lansing, to accept the appointment. A contributor to science teachers' magazines and reports in science education, he is also the author, singly and with others, of ten science textbooks. In the new office, Mr. Carleton will be responsible for many promotional and service activities of the National Science Teachers Association directed toward aiding science teachers at all educational levels.

LETTERS

Dear Sir:

The following is a motivating puzzle which I thought the readers of the magazine might find use. The idea is not an original one. However, I use it to make biology more interesting to high school sophomores.

These are names of North American trees. First fill in the vertical column with the letters spelling a name of a tree. The first letter is given as a clue. Then fill in the horizontal columns with the names of trees whose names begin with the correct letters. The numbers indicate the number of letters in each name. Only the first vertical column spells a tree but all the horizontal ones do.

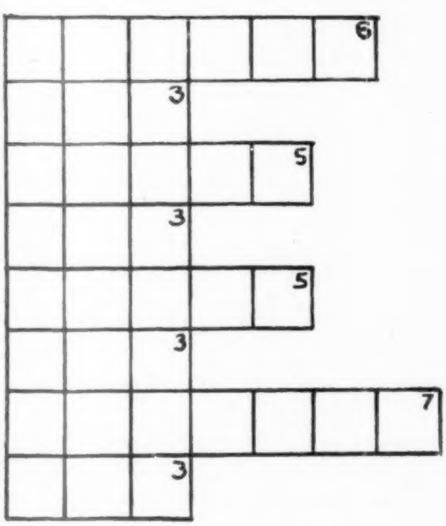
I use one or two of these to begin the study of trees. Students like to make up their own. They can also make up puzzles for the human body, mammals, insects, and others.

Very truly yours,

Verna Weeman,

Albany Senior High School

Albany, New York



Biological Briefs

YOUNG, PAUL R. Gardens are Science Projects. *The Science Counselor*, Vol. XI, No. 2, p. 45, June, 1948.

For 40 years the Cleveland schools have maintained a garden-science program; last year 8500 pupils planted gardens, 1200 in school garden tracts and the rest at home. The gardeners work under supervision at all times. Grades are given for the work done and special certificates are given to those who do a satisfactory job. Some of the teaching staff are employed on a twelve-month basis and greenhouse and other facilities are provided. Upwards of 50 boys and girls are hired as student assistants each season. The Cleveland system believes that funds and personnel can always be provided for any activity that is really thought to be important and that gardening, rather than being extracurricular, is a science project of high merit.

EVERETT, T. H. Transplanting is Easy If Your Timing's Right. *Science Illustrated*, Vol. 3, No. 6, p. 92, June, 1948.

Since one of the chief needs of plants is water, it is important to do transplanting at a time when that need is lowest. Another factor of significance is the time at which the roots are repaired most rapidly. Great care must be taken not to allow roots to dry out during the moving process. The most favorable time for moving evergreens is April or September. Iris should be moved soon after blooming. Moisture can be conserved by mulching, i.e. spreading a two or three inch layer of leaves, straw or hay over the soil about the newly planted bush or shrub. Pruning at the time of transplanting will help to avoid excessive loss of moisture trough transpiration.

MOOG, FLORENCE. The Biology of Old Age. *Scientific American*, Vol. 178, No. 6, p. 40, June, 1948.

Senescence and death, which to man seem unavoidable, are not the rule among all species of living things. Fishes, for example, do not grow old because they do not reach an "adult" size but continue to grow as long as they live. A growing organism is biologically young. The real immortals though are the one-celled organisms. When these reproduce by fission, the parent does not die but continues to live in two portions known as daughter cells. The problem from man's standpoint is to determine the factors that underlie the gradual decline of the power of self-renewal. How far the inevitable death can be pushed back is a matter of speculation at present. Some indication is given by such examples as Oliver Wendell Holmes on the Supreme Court bench at 90 and Titian painting *Christ Crowned with Thorns* at 95. What nature can do for some perhaps science can learn to do for most.

REETZ, CARL. Intravitam Staining of Protozoa. *The Bulletin of the American Society of Amateur Microscopists*, Vol. 4, No. 3, p. 39, July, 1948.

Intravitam stains are very dilute solutions of organic dyes which color some of the organelles of the Protozoa without immediately injuring them. Commonly used dyes are Bismarck brown, Congo red, neutral red, methylene blue, janus green B and methyl violet. For best results only those dyes sold as intravitam stains should be used. The effects produced may be very striking. They vary greatly in extent and in time of appearance, so that general statements are almost impossible to make. *Copoda* is colored a uniform light brown by Bismarck brown almost immediately. As the color deepens the food vacuoles become more deeply colored than the cytoplasm. But with neutral red the effect is just the opposite. Bismarck brown and methylene blue together result in brown cytoplasm and blue food vacuoles if the timing is right.

Fish Bite When Hungry. *Science News Letter*, Vol. 54, No. 4, p. 60, July 24, 1948.

To bite, a fish must be either angry or hungry; so says Dr. Samuel Eddy of the University of Minnesota. Normally fish start feeding early in the day, spend the middle of the day digesting their food and

search for food again in the evening. Most game fish locate their food by sight, but some like catfishes and suckers have well developed chemical senses; still others, like the crappies and sunfishes, use a combination of taste and sight. Fishing is mainly an attempt to fool the fish into thinking a lure is something to eat. When a fish is not hungry all human art and cunning are to no avail. "So the real reason a fish bites," the expert asserts, "is because the fish is either hungry or mad."

Haseman, Leonard. Insect Needs and Soil Fertility. *Soil Conservation,* Vol. XIV, No. 1, p. 9, Aug. 1948.

Some of the more common crop pests do not thrive best on what constitutes a balanced diet for the higher animals but get along better on crops grown on unbalanced mineral levels. For example, the chinch bug prefers and does better on corn grown in nitrogen deficient soil. It seems that as we deplete soil fertility we make conditions more favorable for growing crops increasingly better for insects and poorer for man and livestock. It is possible that in the future commercial fertilizers will be adjusted not only to the soil and the prospective crop to be grown but also to the insect pests likely to be encountered. The fertilizer may then increase crop production and also render the crop less satisfactory for insect food while it is being improved for human or domesticate animal food.

The Dawn-Redwood. *American Forests,* Vol. 54, No. 8, p. 352, Aug. 1948.

Dawn-Redwoods (the genus *Metasequoia*), the great prehistoric trees that were kings of the forests when dinosaurs ruled, are growing in North America again after an absence of some millions of years. Fossils of this conifer have been found in Alaska, Greenland, Oregon, California and elsewhere. About two years ago reports came from China of the discovery of living *Metasequoia* far in the interior of the land. Near a remote village never before visited by foreigners, an expedition led by Ralph W. Cheney of the University of California and the Carnegie Institution of Washington and Milton Silverman of the *San Francisco Chronicle* located the trees. They brought back specimens of the wood, bark, leaves and cones, as well as four living seedlings. These were planted in April in Berkeley, California. *Metasequoia* is readily distinguishable from the American *Sequoia,* although the two are closely related, the former probably representing a form ancestral to the latter. Plans are being made to preserve an area of *Metasequoia* in the Valley of the Tiger.

Books

de Laubenfels, Max Walker, *Life Science,* 3rd ed. Prentice-Hall, Inc., New York 11. iv + 340 pp. 1024 illus. 1946. $4.75.

This unique survey-type textbook, covering the various fields of the biological sciences at a freshman college level, is a republication of the author's revised second edition which appeared in 1943. The book is printed in offset style, with a two-column arrangement, and is profusely illustrated with 745 simple yet informative line diagrams and 279 photo reproductions. It will be welcomed by those who support the educational philosophy that survey-type courses are of great orientation value for beginners in the college sciences. The text matter and illustrations evidently have been carefully prepared and arranged to meet the needs of the college student, first probing the various life science subject areas with perhaps some notion of later specialization, as well as the general reader. Fundamentals of biophysics, biochemistry, cytology, embryology, histology, anatomy, physiology, psychology, immunology, dietetics, botany, taxonomy, bacteriology, zoology, oceanography, parasitology, entomology, zoogeography, ecology, genetics, eugenics, paleontology, anthropology and biological philosophy are covered with amazingly little overlapping. The introductory chapter is devoted to a consideration of the scientific approach and sets forth the author's ideas of the functions of the biological sciences in the whole educative process.

In a number of places the author digresses

from the purely scientific to point a moral or social value. Some may be disturbed by this material appearing in a science textbook and feel it should be left to individual interpretation. The treatment of the topic "Adaptations" on pp. 252–253 seems especially well done. Certain errors in typing and make-up of the copy for the offset process make the book awkward to read, especially where paragraphs are duplicated or disarranged as on pp. 44–45. On the whole I like the book and shall welcome an opportunity to try it out in a college survey-type science course.

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WHEAT, FRANK M., and FITZPATRICK, ELIZABETH T. *Health and Body Building* American Book Co., New York. ix + 517 pp. illus. 1947. $2.08.

Health and Body Building is a basic text for health and physical fitness programs in high schools. The textual matter, which is mostly informational, is divided into ten units each of which is made up of several problems. Each problem concludes with two sets of student activities—Interesting Things to Do and Questions to Answer. These require the pupils to make practical applications of the facts to their immediate health needs and to the sanitation of their local environment. It would seem that a closer check of the factual material would have prevented several errors of a minor nature. The language used, the arrangement of materials, and the illustrations are well chosen and interesting.

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ALTENBURG, EDGAR. *Genetics.* Henry Holt and Company, New York. xii + 452 pp. illus. 1945. $3.20.

This book was apparently written for the general college student. In text and illustrations the study of chromosome structure and chromosome behavior as they affect hereditary traits is emphasized. Drosophila is the favored illustrative form. The author's expressed purpose is to emphasize modern genetics. The wide range of topics considered is indicated by the titles of the twenty chapters. Listed in order these are: The Physical Basis of Heredity; Heredity and Environment; Mendel's Principle; Independent Assortment; Multiple Factors; The Determination of Sex; Inbreeding and Outbreeding; The Genetical Interpretation of Sex; Selection; Linkage, Crossing Over, and Chromosome Maps; Crossing Over and Meiosis; Multiple Alleles; Abnormal Chromosomal Rearrangements; Cytogenetic Maps; Genic Balance and Chromosome Number; Mutation; The Artificial Production of Mutations; Balanced Lethals and Chromosome Complexes; Heredity and Development; The Genetic Basis of Evolution. Each chapter concludes with a Summary and a list of Problems.

The concept of probability is touched very lightly, and there are no applications of statistical tests to genetics ratios. The style is readable. Here and there may be found statements that may be questioned, such as "When corn is grown it is the practice of the grower to pollinate the seed-bearing plants with pollen from different plants rather than with their own" (p. 139) or "The best breeds of horses, dogs, and other domesticated animals are usually closely inbred" (p. 140). There is no bibliography and only a few complete citations to published works in genetics are given, although the contributions of numerous investigators are mentioned. In the discussion of evolution the names of Charles Darwin and Sewall Wright are not referred to. All but about 16 of the 148 figures are line drawings; the few halftones included are not as clear as they would have been had the publisher used a heavier grade of paper; this use of light stock is a fault of many textbooks in recent years. There is an index but no glossary. The type is clear and legible.

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CORONET FILMS has issued a new catalog which includes, in addition to a short description of each production, the recommended grade levels for which each film is designed, the educational collaborator, length and price. A "utilization chart" in the back of the catalog lists the films with suggestions concerning suitable areas of study. The catalog may be obtained free of charge from CORONET FILMS, *Coronet Building, Chicago 1, Illinois.*

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Articles are scheduled for publication in approximately the order of acceptance of the manuscripts. Generally the journal is tentatively arranged about three or four issues ahead, and there are under consideration at any time enough manuscripts for about two or three more issues. Some space is of course allowed for news items and articles of a seasonal nature. On the average, a manuscript submitted this month may expect to find its way into print, if it is accepted promptly, in about March or April. Many seasonal papers have to be postponed an entire year, simply because the author has not allowed the necessary four to six months that intervenes between acceptance and publication.

For details concerning titling, headings, references, illustrations, etc., consult *Preparation of Manuscripts for Publication*, which appeared in the October, 1943, issue of THE AMERICAN BIOLOGY TEACHER. A limited number of reprints is still available; copies may be obtained from the editor.

Manuscripts may be sent to the editor-in-chief or to any one of the associate editors. A complete list of the latter appears in each October and February issue.


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